Menlo Park Notebook #51 [N-80-03-29]

This notebook covers the period March-September 1880. Most of the entries are by Charles Batchelor. There are also entries by Edison and John Ott. Most of the material relates to the development of the carbon filament lamp. Included are notes, calculations, and drawings of machines for cutting and moulding the filaments, for making clamps, and for rolling connection wires; notes, calculations, and drawings of filament designs and vacuum experiments; and lists of carbonized materials. There are also notes, calculations, and drawings of the electric railroad; a draft letter from Edison to Babcock and Wilcox concerning steam boilers; a draft letter from Batchelor to Franklin H. Badger concerning telephone central exchange systems; and a short list of publications. The label on the front cover was originally marked "LAMPS Beginning Mch 29th 1880." Later a "C" was added to make it "CLAMPS." The book contains 283 numbered pages.

Blank pages not filmed: 128-129, 192-193, 250-263, 266-267.

Missing page numbers: 157-158, 279-282.

Index.

Calcimatic ... 5, 9, 65, 76, 77, 78, 79, 101, 102,
" 103, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144,

1657 Index.

LIBRARY OF THE

BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

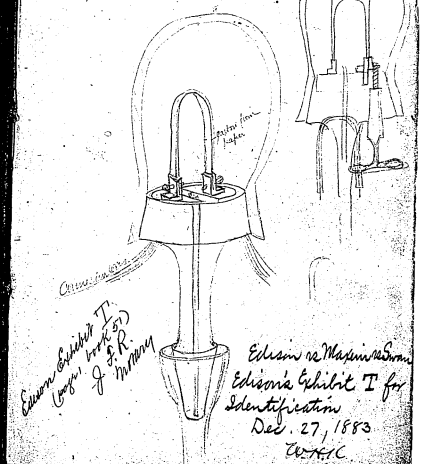
—/—

GENERAL ELECTRIC.

——————————, 189-.

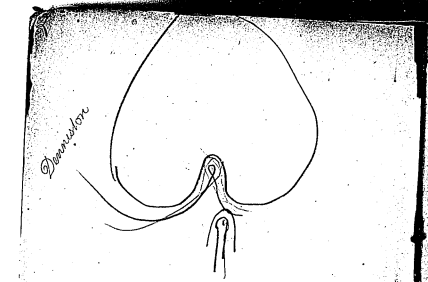
Carbonizing in Vacuo

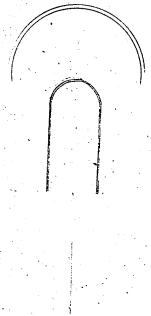
Shellac Patchett

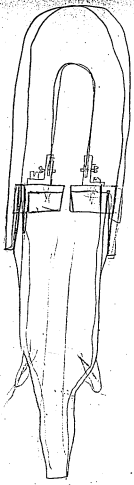


Edison Exhibit I
Copyright by F. R. Murray

Edison vs Maxim Sawyer
Edison's Exhibit I for
Identification
Dec. 27, 1883
Notary


Dimension





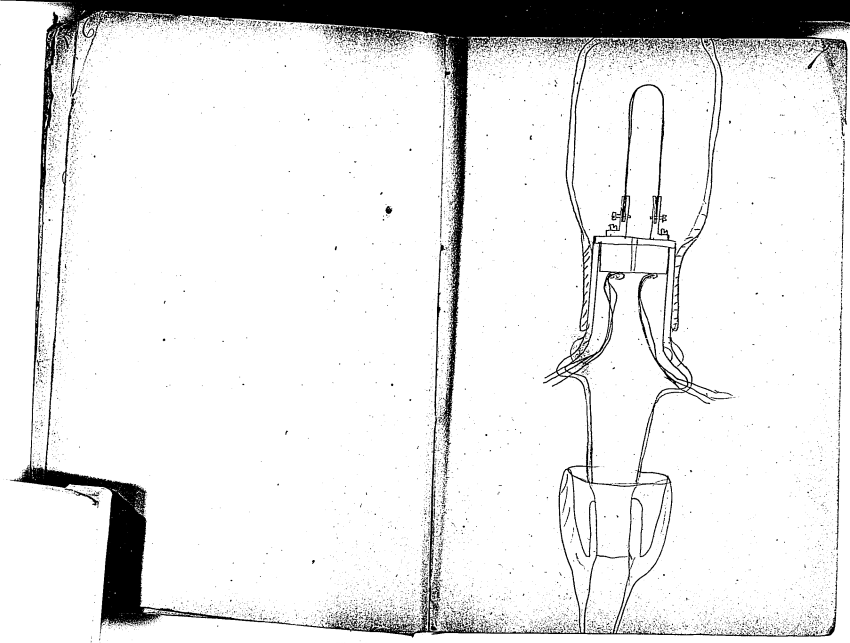
$$C = \frac{Q}{V} = \frac{6C}{6R+12} = \frac{6C}{6R+12} = 3$$

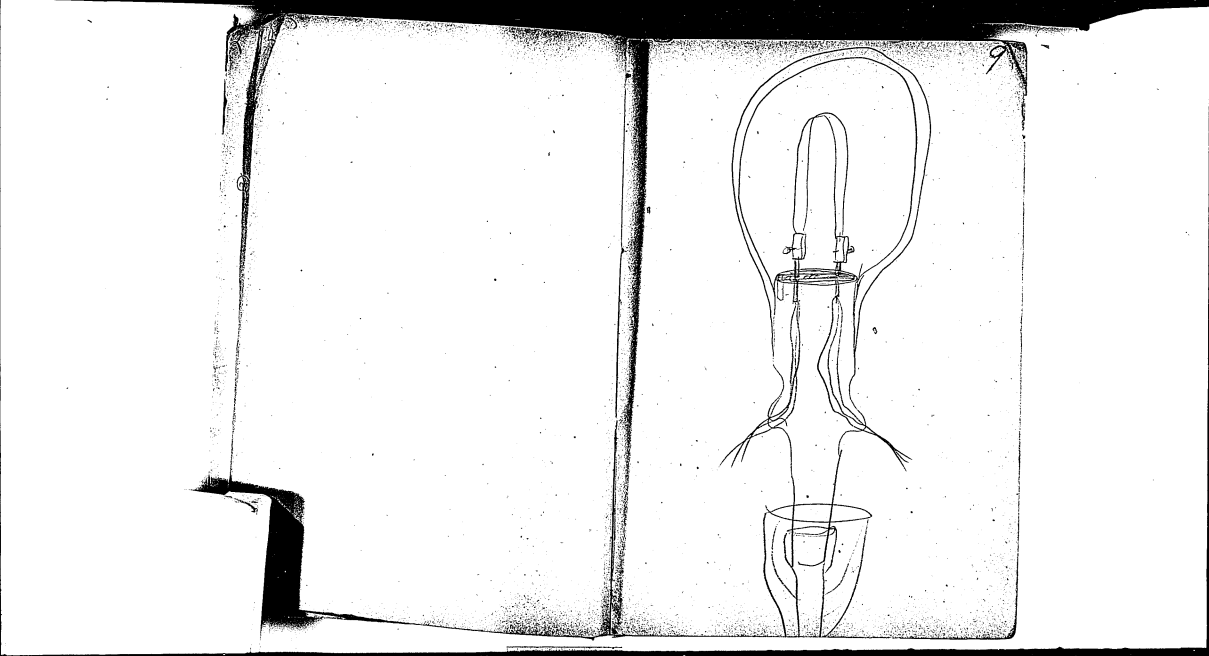
$$\frac{6E}{6\times3+12} = \frac{6C}{30}$$

$$C = \frac{3E}{3R+3} = \frac{3E}{3\times1.5+3} = \frac{3E}{7.5}$$

$$C = \frac{3E}{\frac{3R}{2}+12} = \frac{3E}{\frac{9}{2}+12} = \frac{6E}{33}$$

$$\frac{3E}{\frac{9}{2}+12} = \frac{6E}{13}$$

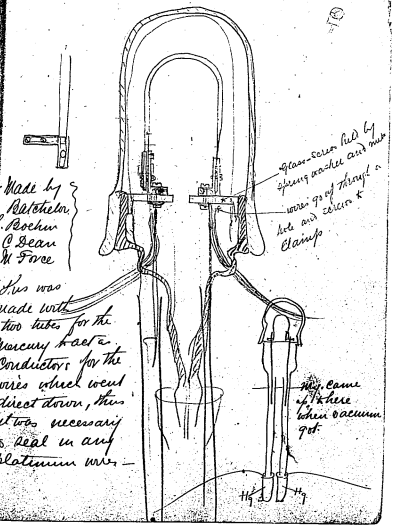




195
156
19

183
19.6
7

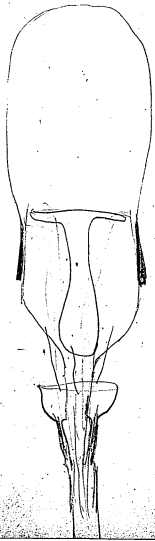
Cartridging in Vacuum Oct. 29 1901
Chas Satchell

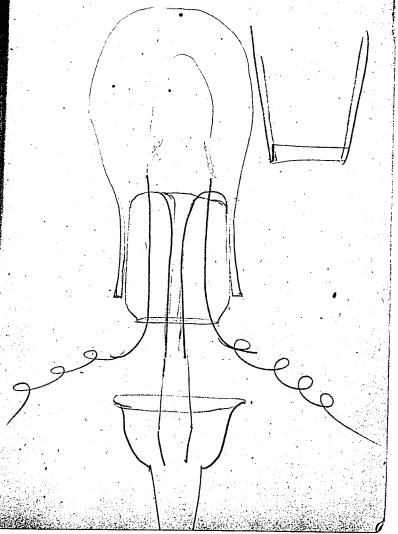


Made by
Satchell
Boehm
Bean
Force

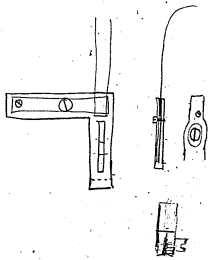
This was made with two tubes for the mercury back conductors for the wires which went direct down, this it was necessary to seal in any platinum wire

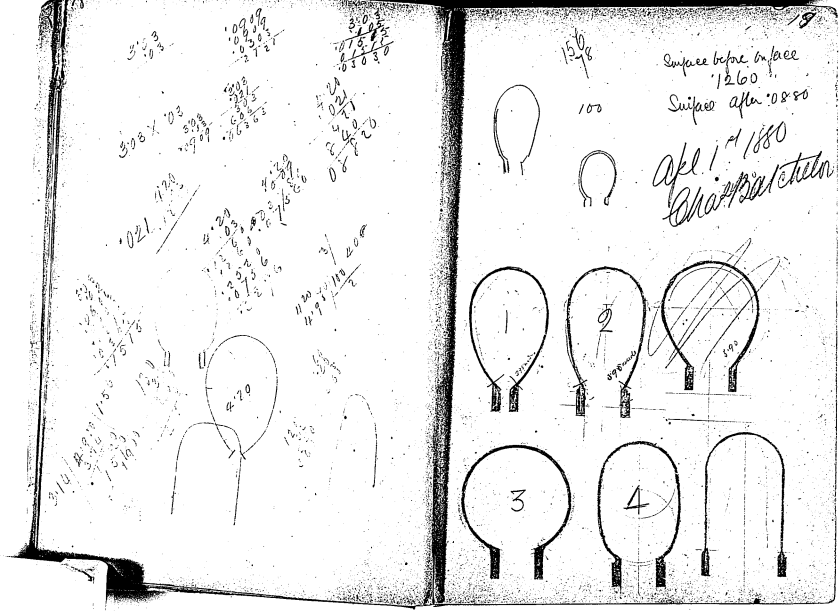
Hg came up these when vacuum got





Завощить и Гасить




Surface before surface
1260
Surface after 0880
Axel 1st 1880
Champ de Chelin
1
2
3
4

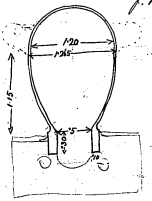
Jars Mould for paper Cup
April 1st 1885
Graphotype

.12 X .01 =

.015
.160
.060
.000
.60
.1200

.02
.04
.08
.08
.06
.24

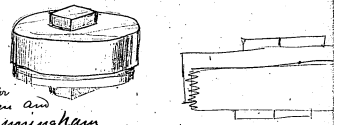
J. Bradley
Made this one
April 6th



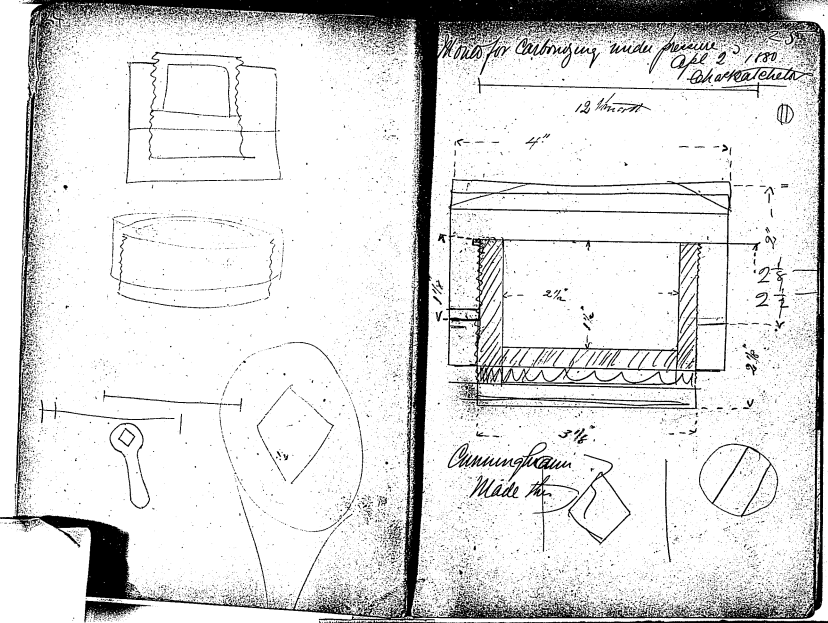
Apl 2 — 1860 — 23

Chatterton

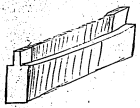
Mould for Carbonizing under pressure



Chatterton Myers and Cunningham Made this B.


Moto for Carburizing under pressure
Apl 2 1880
Charles Batchelor
12 Inches
4"
2¼
3⅛
Cunningham
Made this

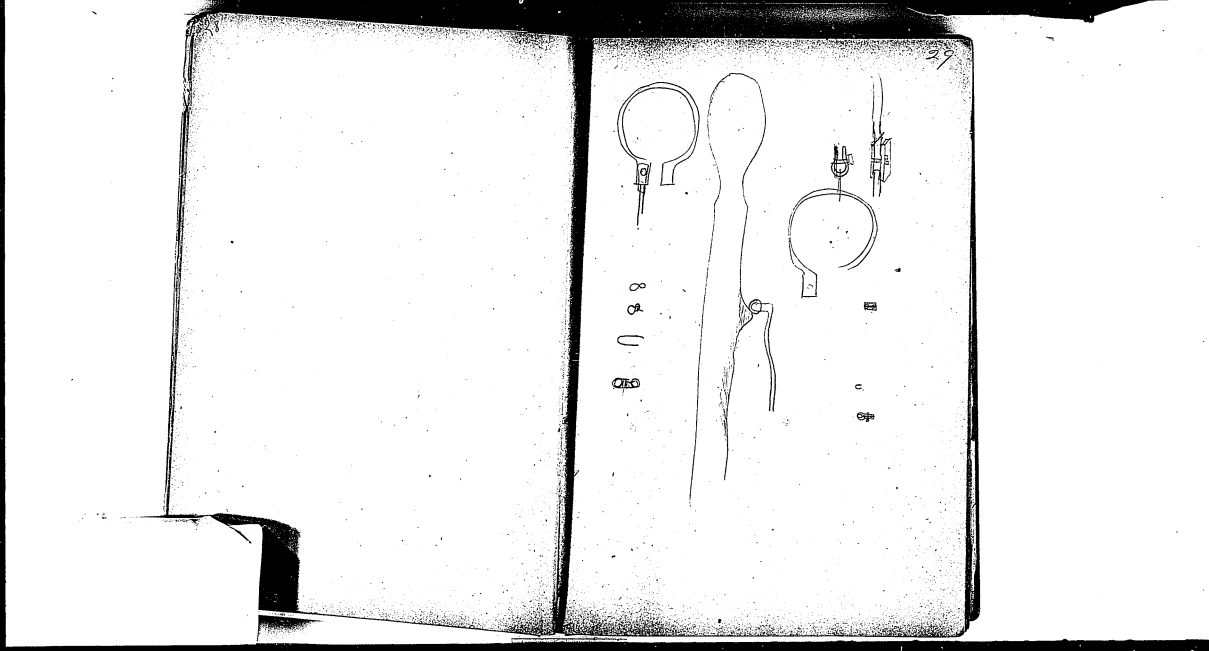
Lamps made from Wood Loops
April 6th 1880
Shavings Catcher



Triple cutter for shaving the formed wood

The piece of wood cut the
4 x .02 x .02 and bent into shape
by steaming or heating process

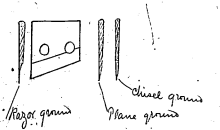
Edison vs Maxim et Swan
Edison's Exhibit V for identification
Dec 7 1883



Knife for Shearing Corks from wood

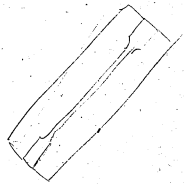
April 6th 1880

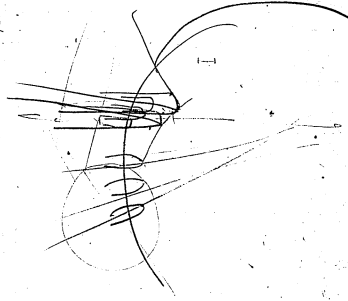
Chas B. Batchelor

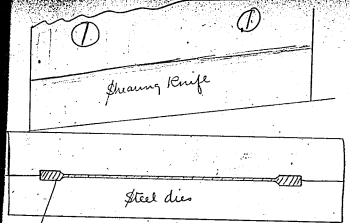


This Knife same shape as this ground like the above

2 Dozen Made Thus







Wood in between Steel dies to be fed out just the right distance and sheared off by the knife above as in veneering

Woods that we cut for the process of making loops from wood: — Apl. 7th 1886

1 White Holley X
2 Willow X
3 White Thorn X
4 Bass wood X
5 Apple X
6 ~~Maple~~ X
7 French poplen X
8 German pine X
9 Lilly X
10 Beech X
11 Pear
12 Gum X
13 White Birch X
14 Cherry X
15 White Oak
16 Black Oak
17 Ebony X
18 Pin oak
19 Box wood X
20 Camphor wood

Elm Satchefa or Mt. of Iron

21 Satin wood X
22 Ash X
23 Hickory
24 Crabwood
25 Rosewood
26 Logwood X
27 Black Thorn
28 Red Cedar X
29 White wood X
30 Spruce X
31 Mulberry
32 ~~White~~ Elm
33 Mahogany X
34 Bay wood
35 Horse chesnut
36 Brazil wood
37 Logwood
38 Locust

Woods continued

39 Lancewood
40 Buttermut
41 Cottonwood
42 Amaranth X
43 X Hemlock X
44 X Pine (white) X
45 Chestnut
46 Alder
47 Currant wood
48 Quince
49 Hawthorne
50 Walnut X
51 Cocoa wood
52 Hazel
53 Red Oak
54 Peach tree X
55 Peppridge
56 Sumac
57 Birdseye maple
58 Sassafras
59 Sycamore
60 Persimmon
61 Hawberry
62 Apricot
63 Gruengage
64 Damson
65 French plum

Woods we cut up for Copps, April 7th 1850. 39

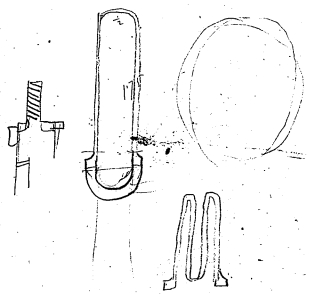
Chas Colchester
M A Forest

66 Banana
67 India rubber tree
68 Briar (Sweet)
69 Lignum Vitae
70 Lion wood
71 Blood Wood
72 Cypress.
73. Slippery Elm
74 Tiger wood-
75 = Vegetable Ivory
76 Sheetam wood.
77- Willow wisps
78 -Goosberry
79 Sandal (wood)
80 Cocobola.
81 Lemon

82 Orange
83 Smell wood
84 Date-
85 Grape
86 Fig
87 Libre Tree
88 Filbert
89 Juniper.
90 Eucalyptus
91 Upas.
92 Bamboo
93 Olive
94 Granadilla
95 Ebuava,
96 Spreewood
97- Citron
98 Pomegranate

99 Scrub oak.
100. Chinconia.
101 Aloe,
102 Ailanthus
103 Acacia.
104 Magnolia
105 Buckeye,
106 Pecan
107 Sage bush
108 Manzanita
109 Myrtle,
110 Cork
111 Cascarilla
112 Croton
113 Teak
112 Cranberry
113 Huckleberry
114 Mesillite
115 Ivory
116 Dragon
117 Lignum
118 [illegible] Gopher
119 Tamarack
Hackmatack.

Wood. Loops for Canopy Apl. 7/86



120 Tamarind
121 Mulberry wood
122 Bread fruit tree
123 Mahogany
124 Baldam
125 Prickly ash
126 Witch Hazel
127 Lilac
128 Snow ball
129 Cashettie glove ball
130 Prickly pear
131 Barberry
132 Hornbeam
133 Asken
134 Lenwood
135 Leather wood
136 Snake wood
137 Beefwood
138 Ring wood
139 Sassafrass wood
140 Arbor vitae
141 St. Lucien wood
142 Plane wood
143 Balsam apple wood

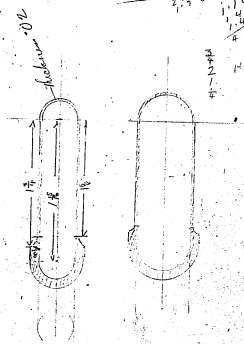
Wood tools for camp Sept 1st 1841

43

Adze Hatchet

144 Zebra wood
145 Sellin
146 Coromandel wood
147 Angica wood
148 Cabbiatour
149 Binas Sapan wood
150 Costarica wood (red)
151 Cuba wood
152 Viset
153 Campeachy blue wood
154 Tatabac blue wood
155 Dommy2 " "
156 Pistachio
157 Pernambuco red wood
158 Japan red wood
159 Puerto Caballo yellow
160 Savanilla "

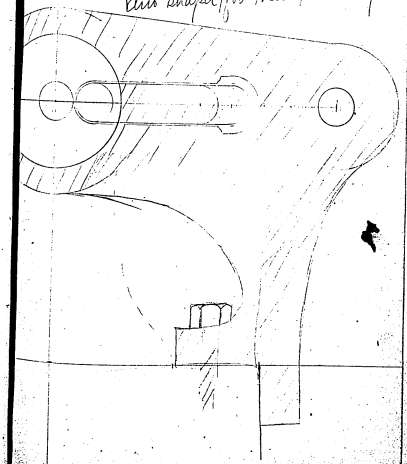
Wire loop for lamps Apl 8th 1880 225
Chas Batchelder



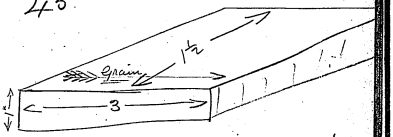
Lamp carbon.

Apl 8th 1880 E.W. Batchelor

Bracket for attaching lamp to a former stud and shaper for new wood loops



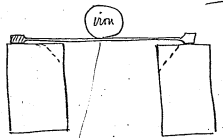
Size of wood for new loops as made and shown on page 45



Make 2 of every kind of wood

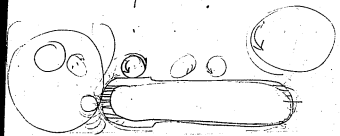
Loops for lamps Apl 10th 1885

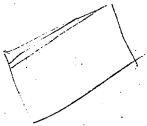
Chas Satchell



Steam them here

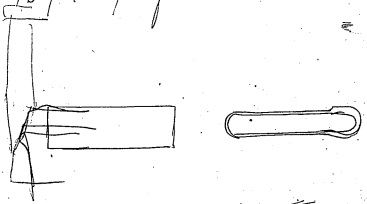
Steam only centre and iron weight will bend down, till it gets almost shape

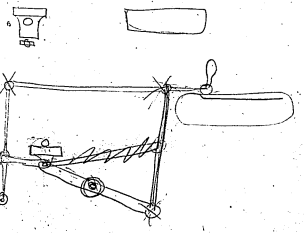




April 13 1881

Very large former Shot Barrel

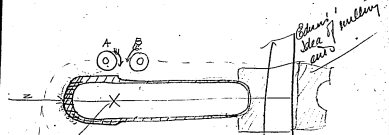




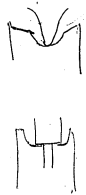
Wooden bases for lamps

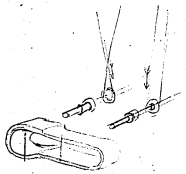
April 13 1880

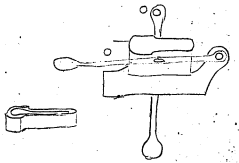
Chas Batchelor

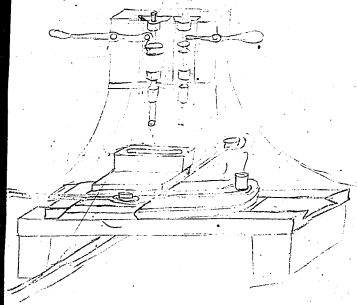


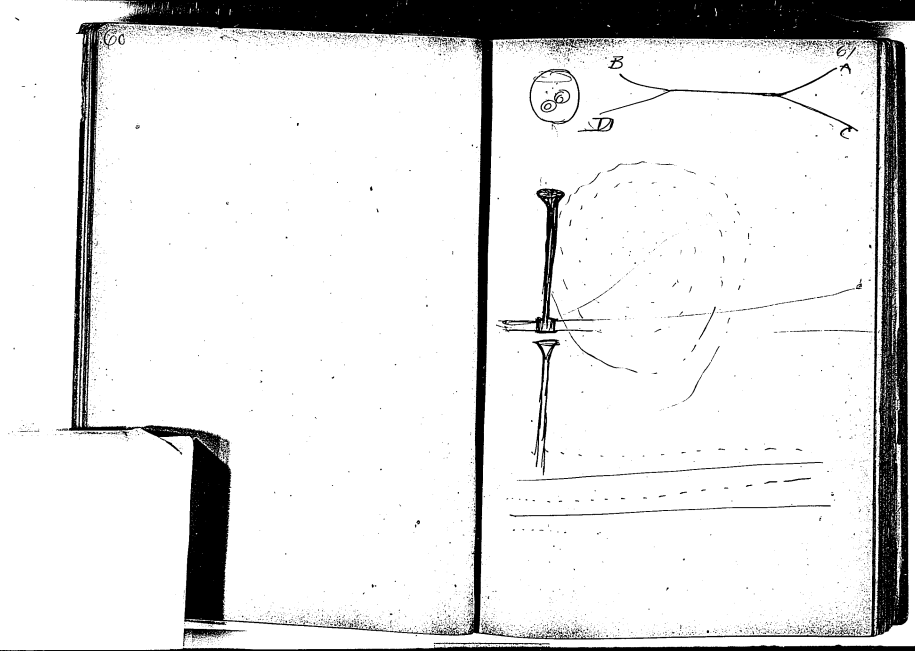
This is milled out first and fed on a mandrel then 2 cutters running in opposite directions operate on one side A running to left & B to right after passing centre line Z they are passing out of way and the wood turned over to do the other side

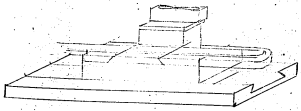


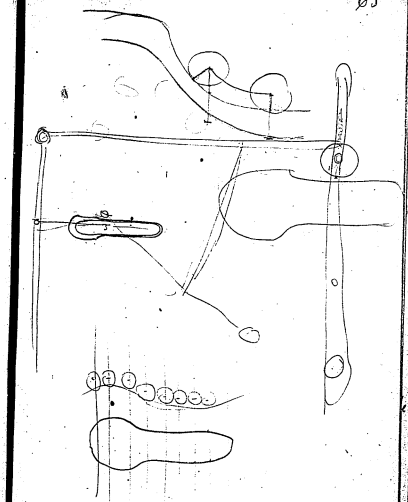


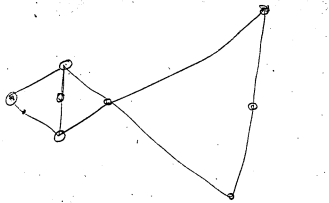


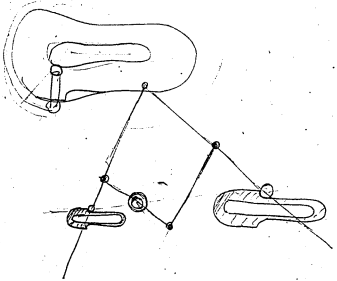



B
A
D
C





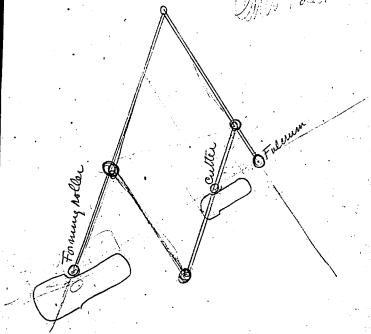


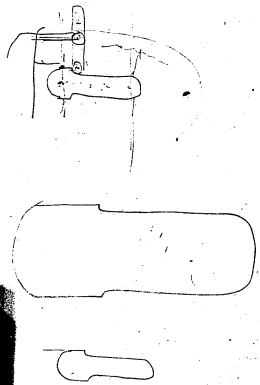


Former Slopes 7 mons

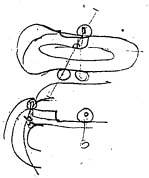
April 14/80.

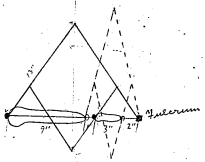
Observed Strata



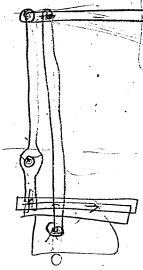


April 14, 1880

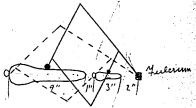




72



73



Can be determined.

New Machine for cutting
closed wooden hoops Apl 15-19

1 Cutter head, block, and bed to be same piece in order to secure rigidity

2 Both former and cutter spindle must work together on a slide with long bearing (so as not to have any shake) and moove about 3 inches

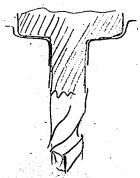
3 Spindle must run at least 6000 revolutions—7500 if possible

4 Former pin must be heavy right to point of working for rigidity

5 Cutter must be spiral of the kind known as (Boats Cock)

6 All the slides must be square instead of bevil and fitted with gibs and screws

7 Spindle and former must stand upright and spindle end bearing must be made so that it will take oil in the shoulder so



Jean will make this just as he wants it

8 Back and forward motion of slides must be extraordinarily long to prevent shake

9 Former will be made with ¼ hole instead of ½.

10 Former will be a little taper in outside and inside and former pin also so that any variation in cutter may be rectified

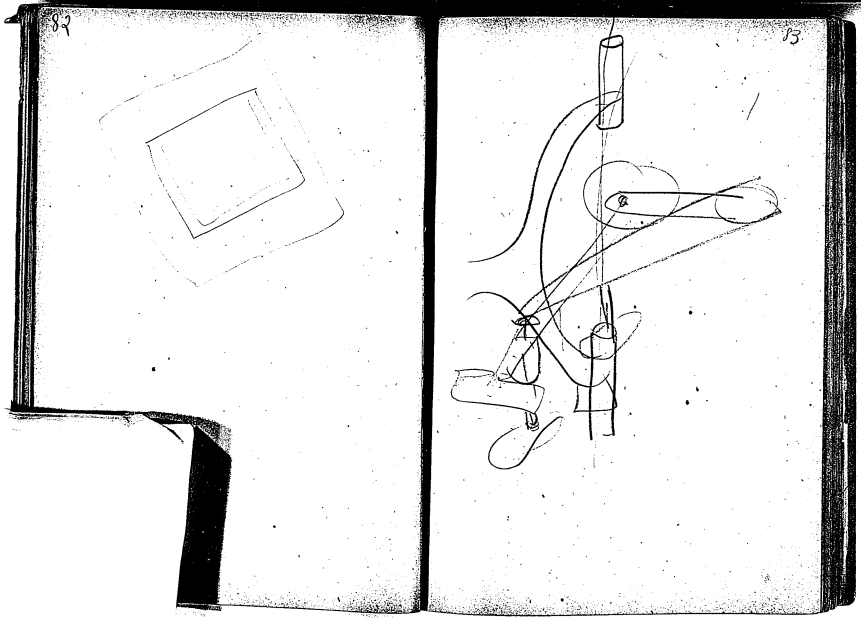
11 Wood must be held by jaws brought together by cam lever — the inside jaw must have two pins projecting as that the work when the

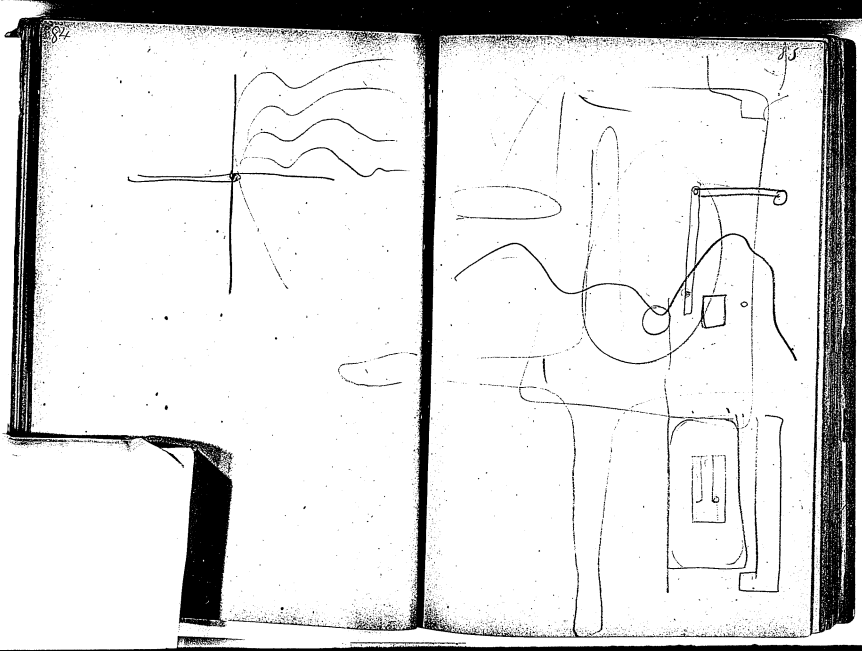
wood is in it is forced upon the two points — This is, so that they will come right in place for finishing cut —

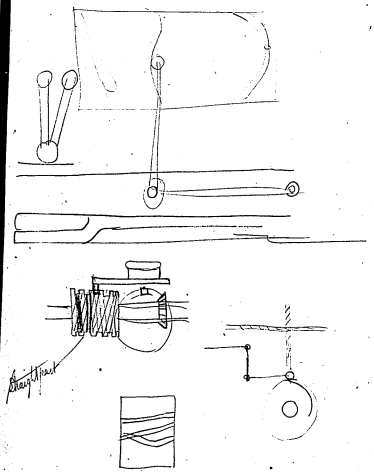
12 Where the cutter spindle bears make large mass of metal to conduct the heat away

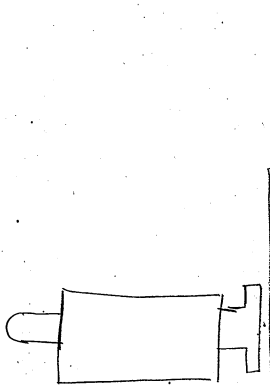
13 Both inside and outside must be roughed out before finishing

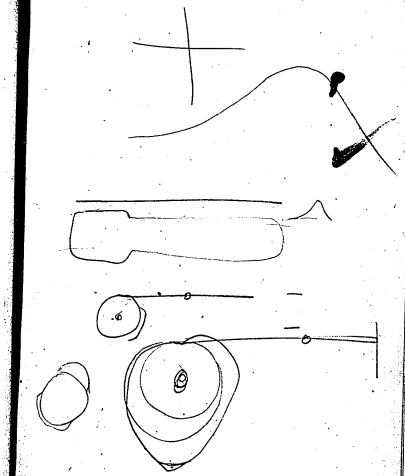
14



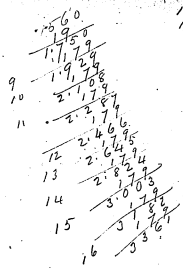



Rotary Heart





Angle piece on slide carriage
must be in 1½ inch upright
carriage bolted must be cut
out



17/18

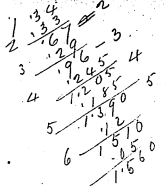
	3361
	178
	3540
	178
19	3718
20	3898
	179
21	4077
	179
22	4256
	179
23	4435

No		
1 =	.05 =	.0167 from periphery.
2 =	.17 =	.039 " "
3 =	.355	.118
4 =	.600	.200
5 =	.890	.297
6 =	1.220	.407
7 =	1.560	.520
8 =	1.750	.583
9 =	1.929	.643
10	2.108	.703
11	2.287	.762
12	2.466	.822
13	2.645	.882
14	2.824	.941
15	3.003	1.001
16	3.182	1.06
17	3.361	1.120
18	3.540	1.18
19	3.719	1.239
20	3.898	1.299
21	4.077	1.359
22	4.256	1.419
23	4.435	1.478

23	4435	40	7411
24	4614	41	7709
25	4793	42	7991
26	4972	43	8266
27	5151	44	8524
28	5330	45	8745
29	5509	46	9005
30	5688	47	9108
31	5868	48	9223
32	6004	49	9293
33	6158	50	9321
34	6339		
35	6516		
36	6695		
37	6874		
38	7053		
39	7232		
40	7411		

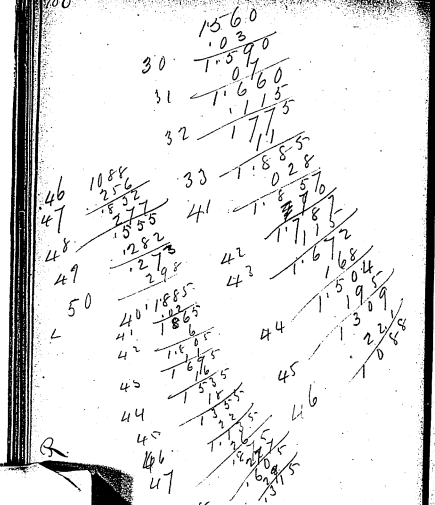
24	4614	1.858	
25	4793	1.898	
26	4972	1.857	
27	5151	1.777	
28	5330	1.777	
29	5509	1.836	
30	5688	1.896	
31	5868	1.953	
32	6004	2.001	
33	6158	2.053	
34	6327	2.112	
35	6516	2.172	
36	6695	2.231	
37	6874	2.291	
38	7053	2.351	
39	7232	2.411	
40	7411	2.470	
41	7709	2.569	
42	7991	2.660	
43	8266	2.752	
44	8524	2.841	
45	8745	2.915	
46	8940	2.980	
47	9108	3.036	
48	9223	3.074	
49	9293	3.097	
50	9321	3.107	

98



99

0	0	
1	34	113
2	167	223
3	916	332
4	1205	402
5	1390	462
6	1510	503
7	1560	52
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		



	1560		
26			
27			
28			
29			
30	1590		530
31	1660		593
32	1775		590
33	1885		628
40	1880		628
41	1857	1865	62
42	1787	1805	60
43	1672	1685	565
44	1504	1535	501
45	1309	1355	451
46	1088	1135	376
47	832	875	29
48	655	605	201
49	273	315	100
50		0	0

11 25
11 25
25
25
13780
187 5

295
282
277
256
221
195
168
115
07
025
1970

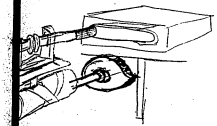
34
33
29
25
185
15
10
10
115
1885

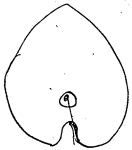
51 30
52 29
53 59
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

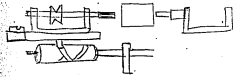
51	30	30	+	10
52	59	59	+	19
53	66	186	+	29
54	92	112		37
55	114	134		45
56	132	152		50
57	148	168		56
58	159	179		59
59	167	185		62
60	168	187		62
61				
62				
63				
64				
65				
66				
67				
68	176	59		X
69	165	55		
70	1545	51		
71	1515	505		
72	1515	505		
73	1465	49		
94	1345	449		
95	1160	39		
96	915	305		
97				

915
290
625
330
295

97 915 305
98 625 207
99 290 110
100 000 0







albo vaque

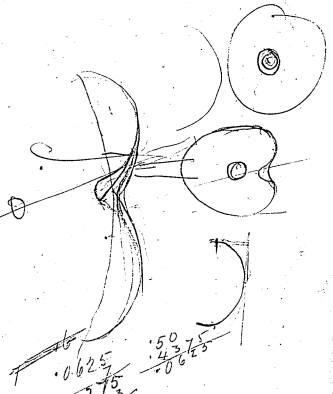
First put in Hook and run a ⅜ bit in and run it back and forward 4 stops

Then put two cams on to work to lines

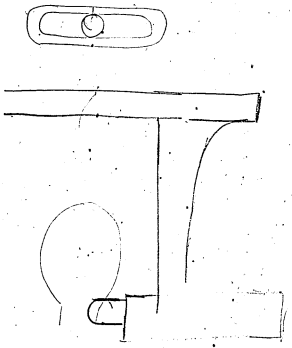
Put this on steel leave and work with 2 cams for outside

Then saw off work the two cams in hole

Width of sides must be .015
thickness of sides must be .015



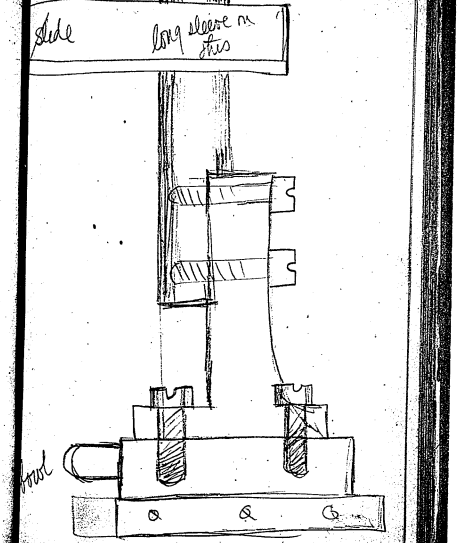
$$\begin{array}{r} .0625 \\ 4\overline{)1.0000} \\ \underline{.00} \\ 10 \\ \underline{8} \\ 20 \\ \underline{20} \\ 0 \end{array} \qquad \begin{array}{r} .4375 \\ 8\overline{)3.5000} \\ \underline{32} \\ 30 \\ \underline{24} \\ 60 \\ \underline{56} \\ 40 \\ \underline{40} \\ 0 \end{array} \qquad \begin{array}{r} .5 \\ 2\overline{)1.0} \\ \underline{10} \\ 0 \end{array}$$

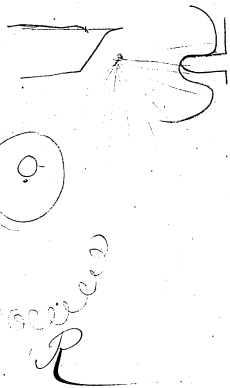


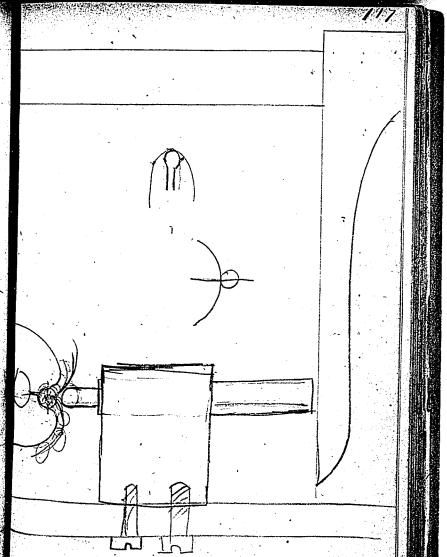
Sideways

1			.020
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

Slide long sleeve as this







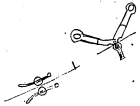
Clamps for Clamps. April 20th 1886

Chas Batchelor

Make screw so:-

Make clamps to screw down through the carbon

Old Clamps and screw together weigh now	·810 mg.
Old Clamps and screw together in rough	·912
Old Clamps and screws now in rough weigh	·766
Old Clamps " " finished — "	·663
to 1 New pair ———	·200

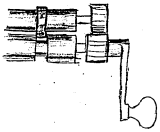


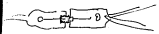
Making Clamps.

Apl 30 1880

Charles A. Steln

Pair rolls for rolling wire = this shape

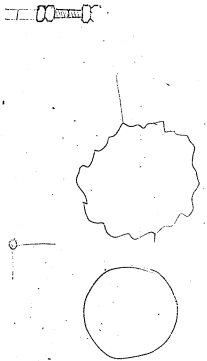




Clamps May 4th 1880 23

Attached some nickel clamps
and Copper ones too —

Chestnut studs

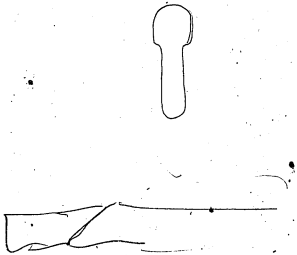


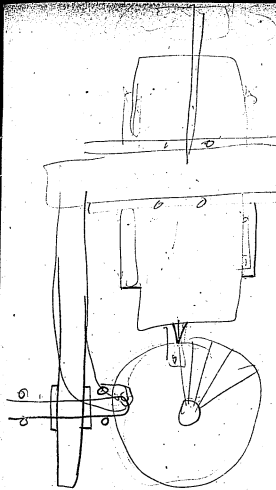
Lamp wires May 6th 1887

We gave over using solder to fasten the platinum to the copper wires in lamps and devised the following plan :-

The end of copper wire has a groove punched in it and the platinum wire is laid in and both fused together in blowpipe flame. The platinum is then polished with bristle and flannel rolls.

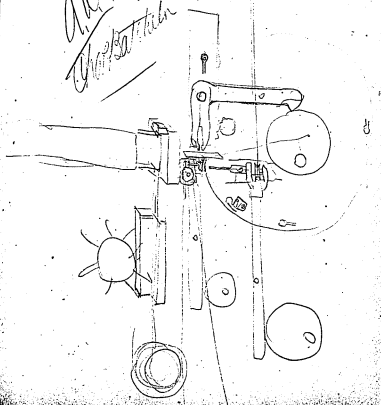
Chas Batchelor





Clamp making machine May 6 1880 55

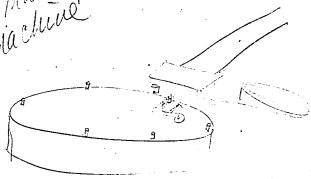
Fig. 1



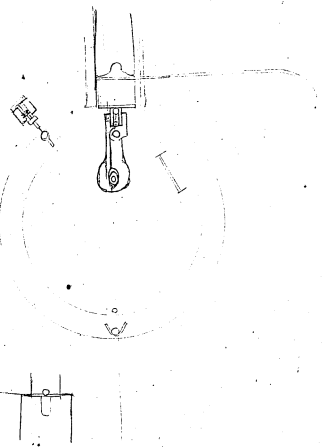
136

May 6th 1880.

Hat making machine



May 6th 1880



$2\frac{1}{2}$ 8 Cu SO_4

39%

33 H SO_4

2 5

3500

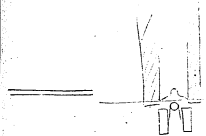
120

11

1320 | 15

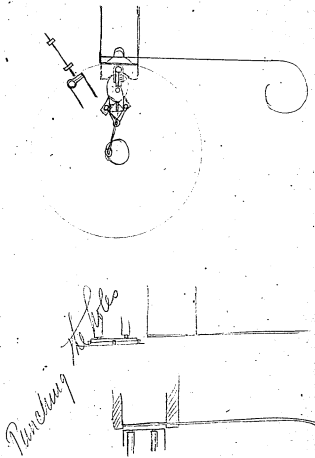
15

540



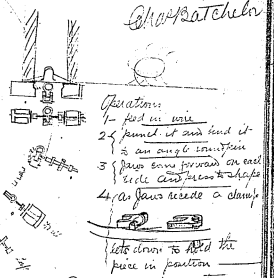
142

143



Clamp making Machine May 8th 1880 145
1880

Clamp patchels



Operation
1- feed in wire
2 { pinch it and bend it
{ at angle to pattern
3 { Saws come forward on each
{ side and press to shape
4 as Saws recede a clamp
falls down to hold the
piece in position

5 Plate moves ¼ of a turn
6 Two magnetic circles one on
each side – one drills through
tapping size – and the other
countersinks one side for stay
size – these two are on one
slide and worked by same
cam but one goes in as
the other comes out.
7 Plate moves again and
the hole is tapped
8 In morning the plate
again the stud that holds

3000 inches
300

4/21

4/21

Diam
Dia. x ½ radius = area

20 X 10

3000
30. 100000

100 x 12.

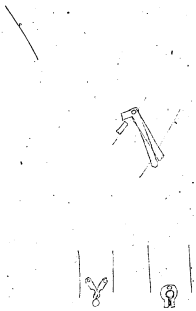
20 x 10

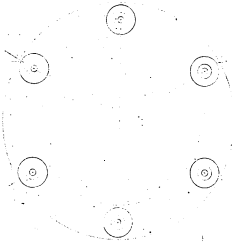
3.14
62.80
3740.
3140.

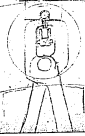
100

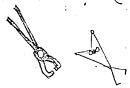
50 - 1962.36
26 - 1962.36
1962.36
1962.36

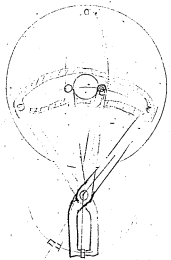
Clamp making
Fig 8 1811
Chapter 138





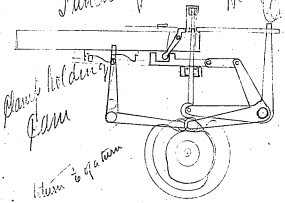






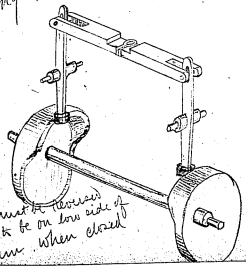
Punching cam and [illegible]

Plain holding cam



Return of 9 a cam

Closing cam

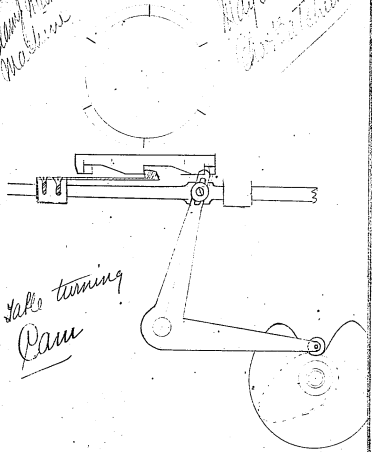


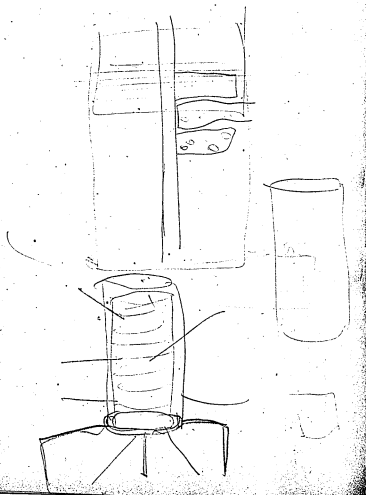
Wire must be removed so as to be on low side of cam when closed

Hand printing Machine

Page 153

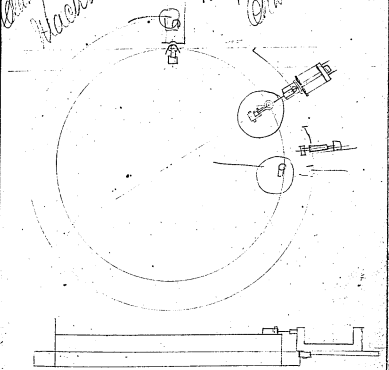
Table turning Ram





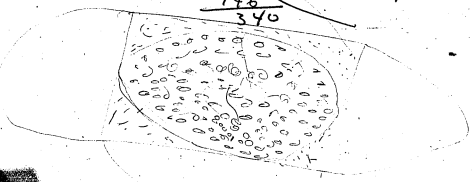
Distilled water machine

May 6 1881



365
4wo
1460000 M+yrs ⊗ 18 grams

146.) 18.00 (.02 cts per M
146
340



May 11th 1850.

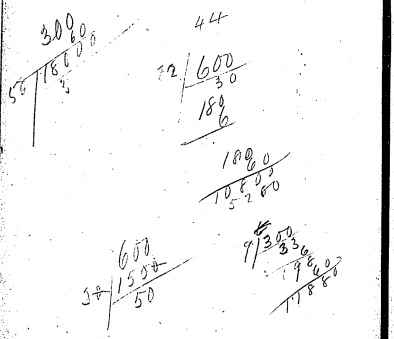
Messrs Peacock & Willcox

Gentlemen

Can you with safety carry 120 lbs of steam on your Boilers and how soon can you put the Boilers up with Safety Valves Steam Gauges Water Guages & Blow out Cocks complete, with the least possible delay,

Yours

J. A. Bivins



Engine

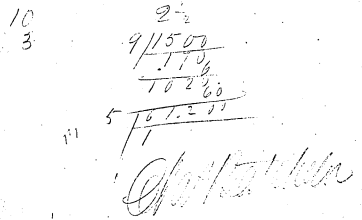
14" drum · 2½ eccentric

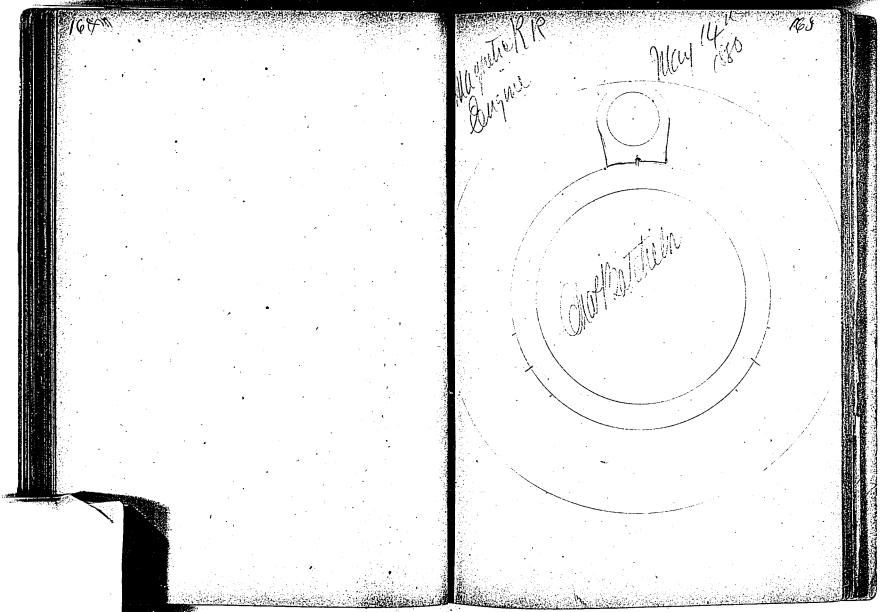
gives 2 on drum

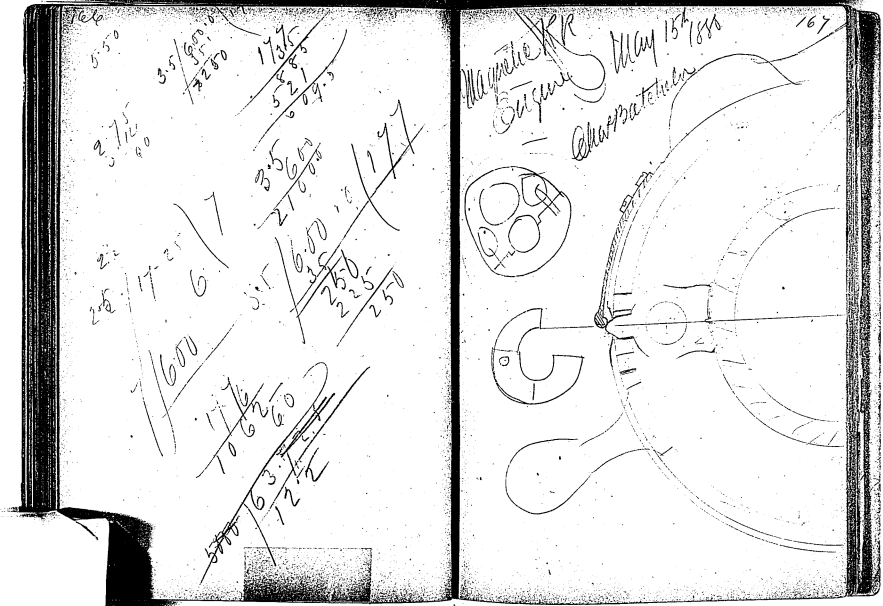
22 ÷ 1 = 60. of Armature

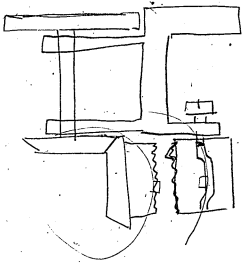
30 Revol of Driver 24"

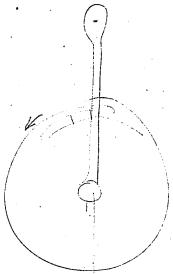
drum.

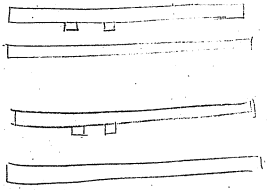


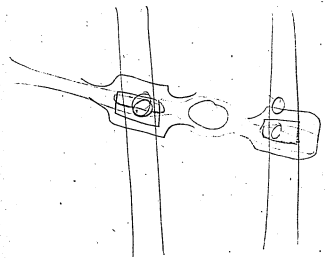










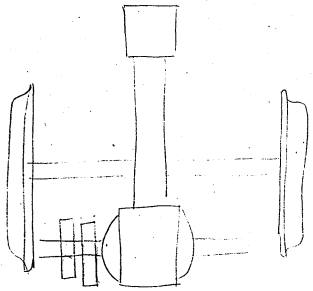


172

$2\frac{1}{2}$ 60

12

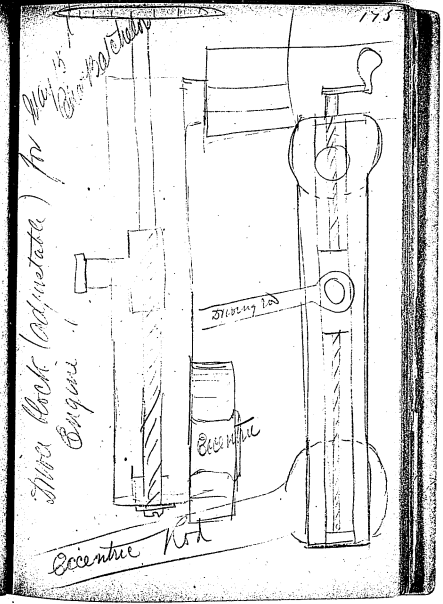
173

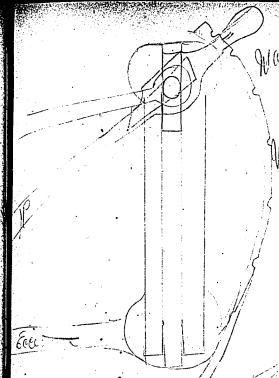


174

175

Slide Rock (adjustable) for Pat. 15" Corliss Engine.



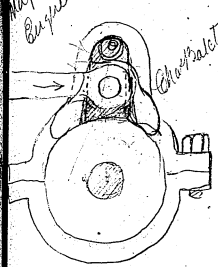

Мед. КК
Енерг
Шеф 15 1980
Електрогастрит
Б
Бял
Линия бяла мастна
Зелен

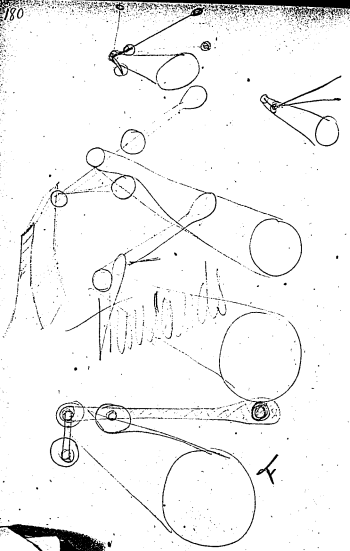
178

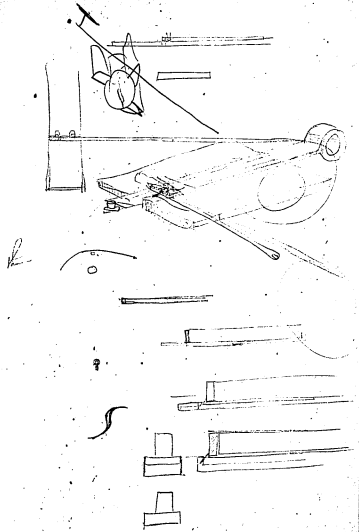
May 15th 1880 179

May K.R. Burgess

Cheesecloth







1·20

80 160

6060

3600

22

160

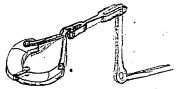
E.

16 5280

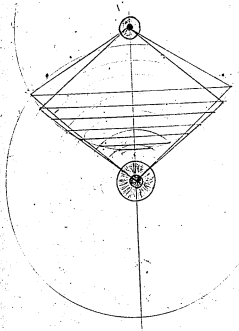
6 880

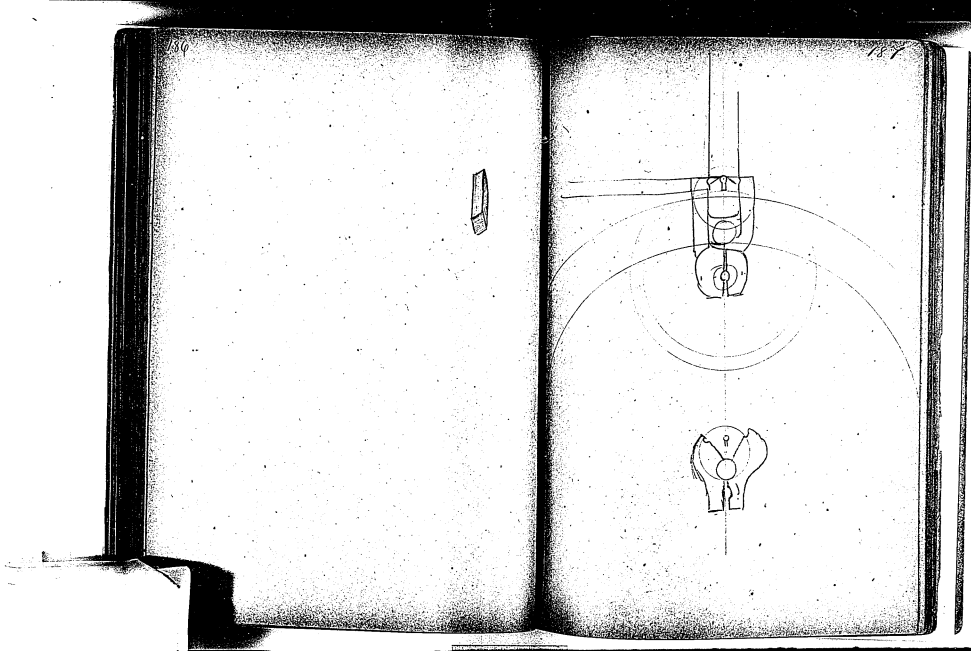
6 8808

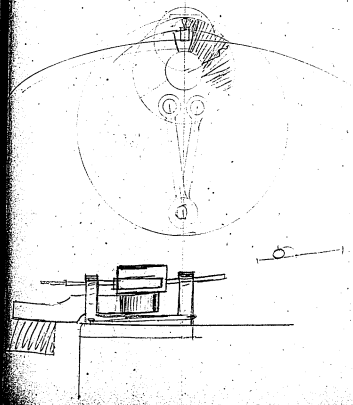
144

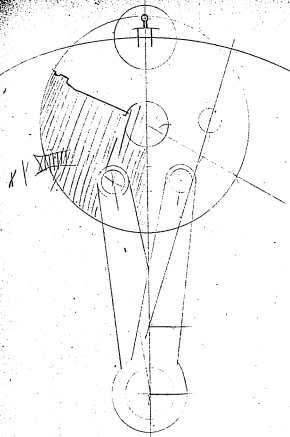


Steven Strogatz



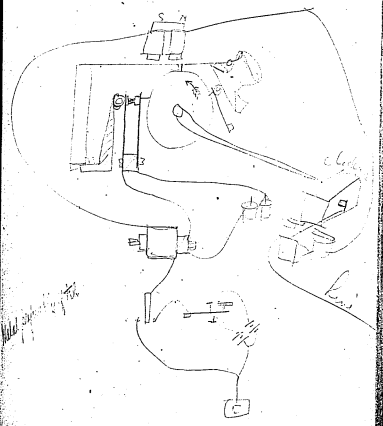




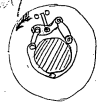

x Y

194

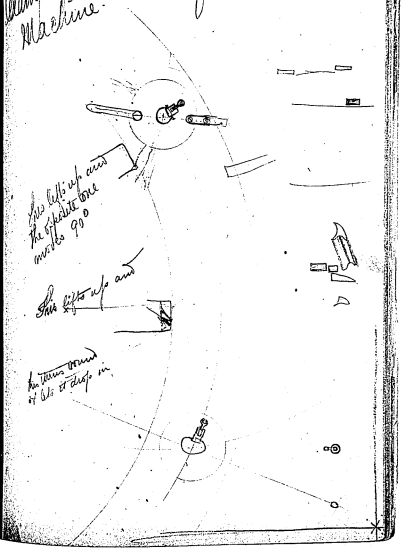
195



RR. engine motions —



Clamp making Machine. June 7th 1880 199



Clamp making machine

In one turn of cams there must be made 80.
1 revolution 100 divisions

Cut and push on pin — Ratchet Cam moves back — 30 div

Bend to shape — 14

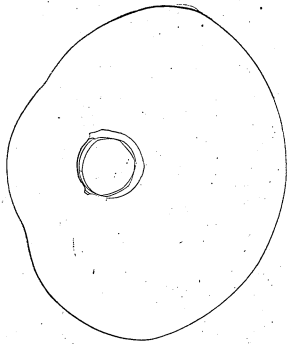
~~Cutter moves past tube~~

Catcher holds it. Cutter moves past back. 13

Bender and catcher cams move out 13

Ratchet moves 1/6 — 30

Bending and tapping cams must be divided into 100 cams as all their work is to 70 as it takes 30 to move



No 1 Cam – Cut off

Use $6\frac{1}{8}$ lever to Cam

And $4\frac{1}{8}$ " to

Cutter moves $\frac{13}{16}$ = Cam bowl lifts $1\frac{5}{16}$

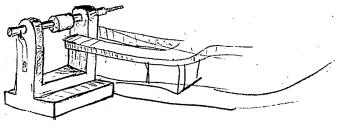
Cam lifts $1\frac{5}{16}$ in 30 division

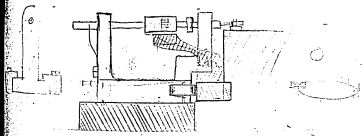
waits 14 division

Moves back in 96 division

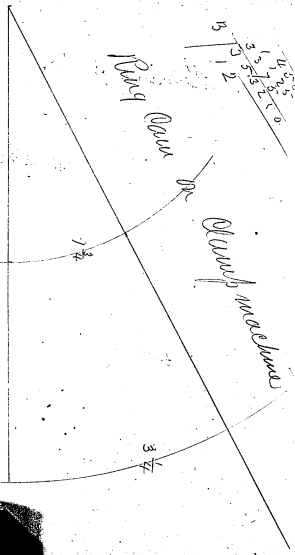
Dead for 30 division

Chamberlain Engine Co. Patent June 7 1880 No. 228455 Fig 1





206

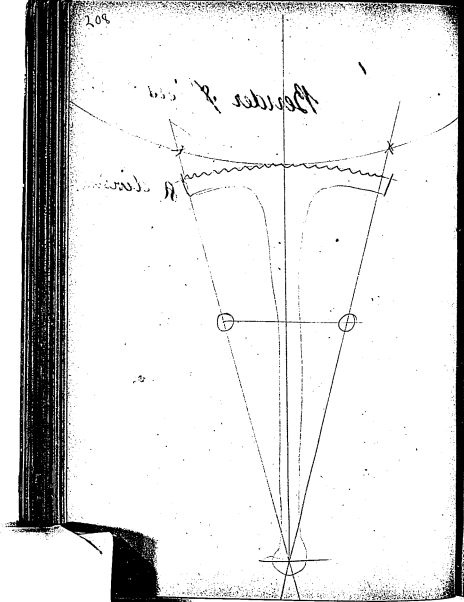


207

No 2 Cam Bender Slides
Left hand

Dead for = 26 divs
~~Lives~~ 1 1/4 in lifts 18 division
~~Retraced~~ 13
Rises out 18
Dead OK 25

Lever 4 1/16 lifts 7/8
Bowl lever 6 3/4 lifts 1 1/4
1 3/4



No 3. Cam

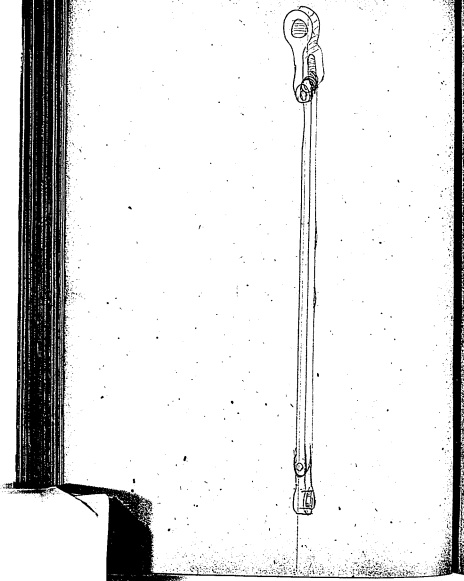
Catch for holding little clamp round pin

	4 dec
Dead	
raises 5/8 inch	13
Advances in	13
Dead	30

Lever 4" — raises 5/8

Bowl lever 4"

OK



No 4 Cam (Ratchet)

Lowers ~~Inch~~ 1 11/16. 1 11/32 44

1 3/32. 26

Dead 30

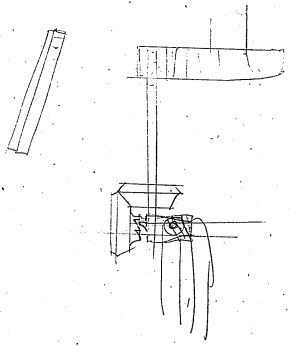
Raises ~~1 mit~~ 1/16 high

Bow lever 6 1/4 ~~1~~ 1 11/16

Stirrup lever 4 3/16 – ~~1~~ 1 3/16

JK

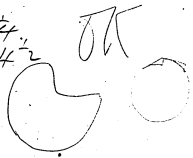
30

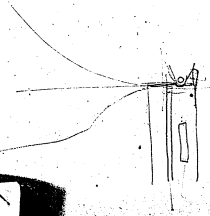


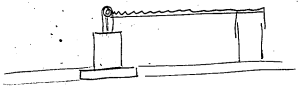
In 5 Ram—
Stop pin

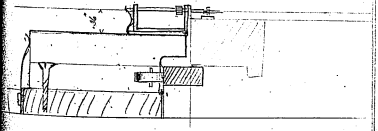
Dead 60
Raises high 90
~~Drops~~ 1
Drops 30
Dead

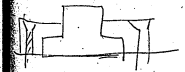
lever 3¼
short lever 4½



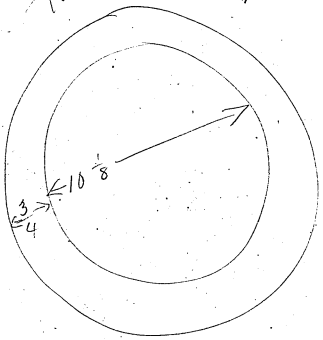




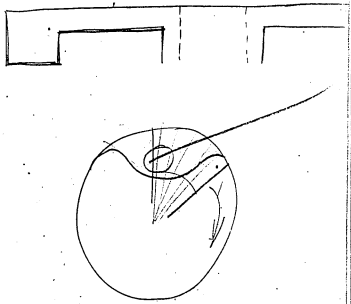


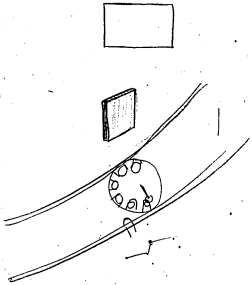


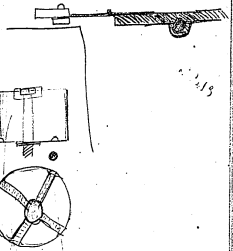
216



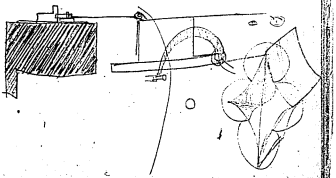
217



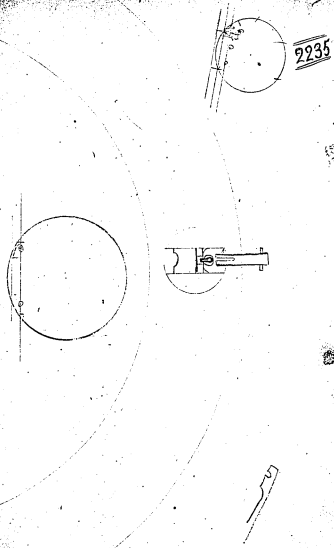




Chap 5



2235



Best future made by Bradley

·009 thick } cut to gauge for length
·011 wide

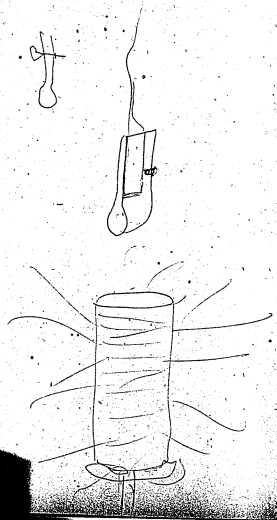
Resis after carb.

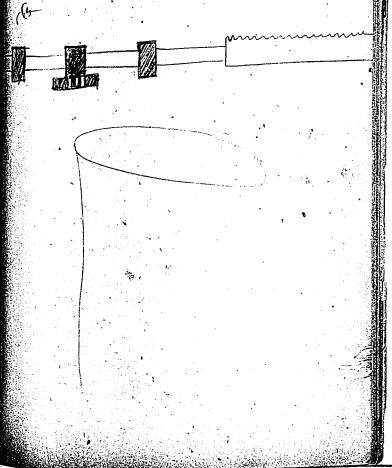
length after carb.

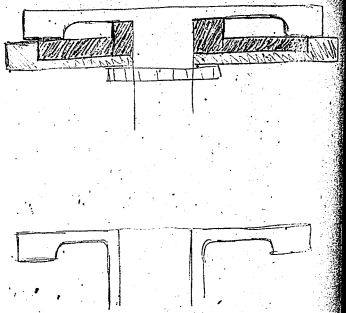
Shrinkage

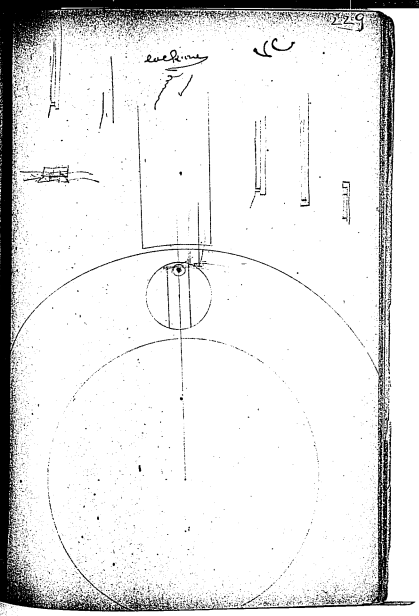
June 29 1910

Make









4000

443 $\frac{\mathcal{E}^2}{R} = 4000$

443 $\frac{\mathcal{E}^2}{R} = \frac{4000R}{R}$ $R = 500$

$\mathcal{E} = \sqrt{4000R}$

$\sqrt{500} \quad 4000$

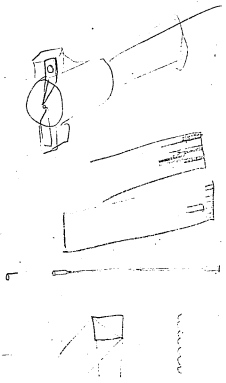
8.

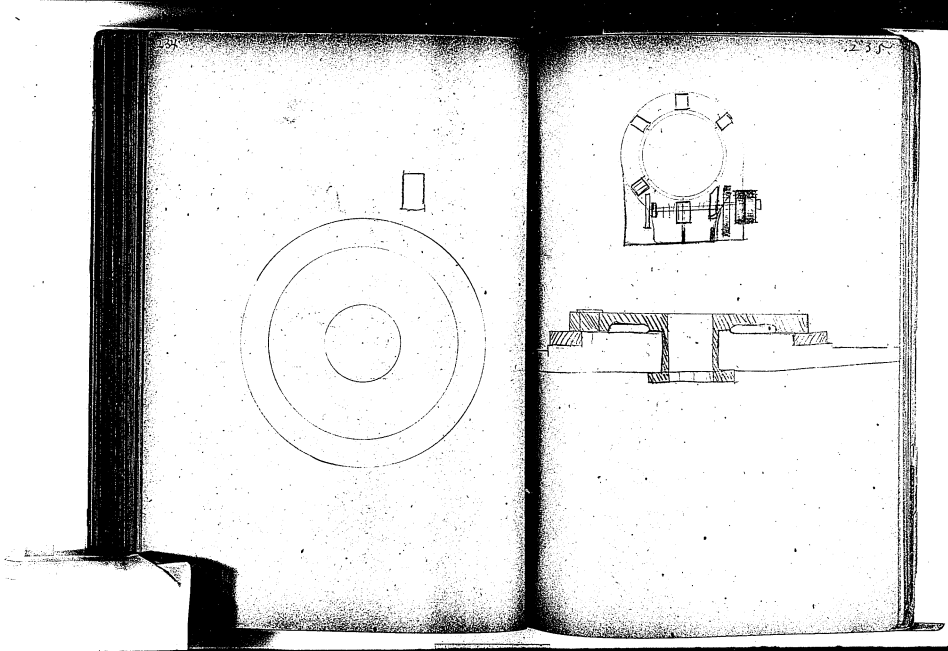
$\mathcal{E}^2 = 4000R$

$\mathcal{E} = \sqrt{\frac{2,000,000}{443}}$

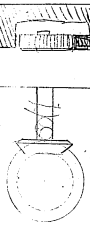
$\doteq 1.4\,\Omega$

212. 6.3010
1.6464
4.6546
2.3273

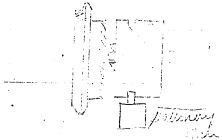




June 28th 1910



Device for rotating movement to Clamp machine



$D' = \frac{N}{P} =$

$D' = \frac{2 \times N}{N \pm 2}$ $\frac{100}{32} =$

32 | 1000 | 3.125
96
40
32
80
64
16

4 3/4
19
18
1 1/2

6 3/8 5 1/4 150
4 1/4 2 0 4
19 4 6 100 X 81
4 3/8 1 1 4

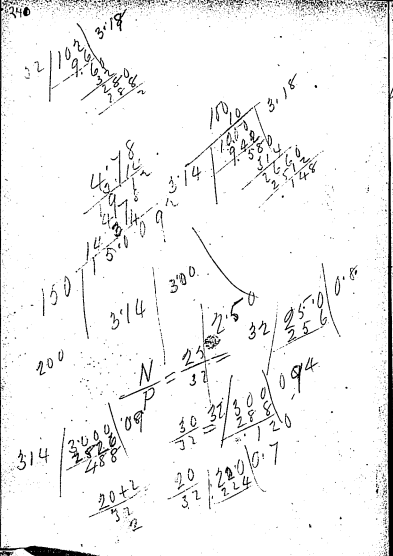
72 ~~teeth~~ at $\frac{1}{8}$ Pitch =

$\frac{72}{8} = 9^{in}$ circum = 2.86

$\frac{120}{8} = 15^{in}$ circum = 4.78

$\frac{20}{8} = 2\frac{1}{2}$ " circum = .80

$1 - \frac{12}{18} =$



100 teeth 32 pitch

Pitch line $= D' = \frac{N}{P} = \frac{100}{32} = 3.125$

Outside diam $= D = \frac{N+2}{P} = \frac{100+2}{32} = \frac{102}{32} = 3.18$

---

30 teeth 32 pitch

Pitch line $d' =$

3.18

25 teeth = pitch line .8

30 teeth " .94

$\frac{25}{32}$

$\frac{25+2}{32}$

$\frac{30+2}{32}$

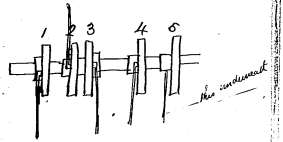
144
4
576

243

210
420
497

Ramp Machine Sept 30th 1880 245

Cams 1
2
3
4
5



1 is Stop pin Cam
2 is Bending Cam
3 is Punch Cam
4 take off.
4 Ring Cam

} All divided into 100 Divisions

No1 Dead 60 div
Rise 9
Drops 1
Dead 30

No 2. Bending Skein

Dead for 26 div.
Falls from " 18 "
Dead for 13 "
~~Heave~~ Raises " 18 "
Dead for 25

No 3. Cutting off Cam

1st Falls for 30 div.
Dead " 14 "
1st Raises " 26 "
Dead " 30 "

No 4 Take off Dam

Drop 3/4 in 41 div.
Dead ~~11~~ 11 —
Raises 48 "

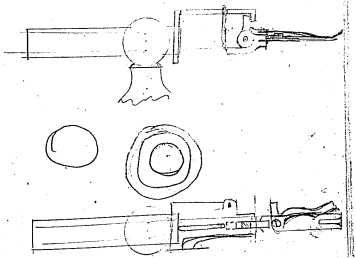
No 5

Drop 2 7/16 = ~~40~~ div
Raise 2 7/16 — 30
Dead — 30 —

Table of Iron Sizes &c.

July 1—

Schuyler

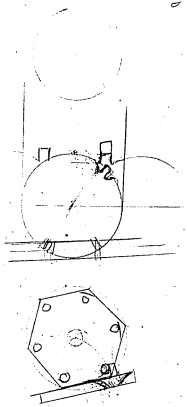


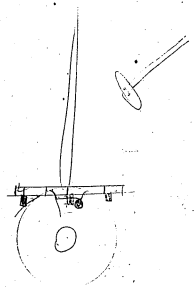
10

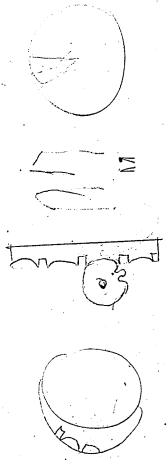
3333
6666
18,330
2660

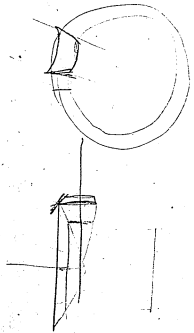
5 1/2
2 3/8
1 1/4

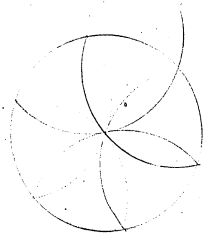
July 1
John Pitt



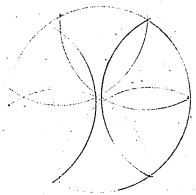
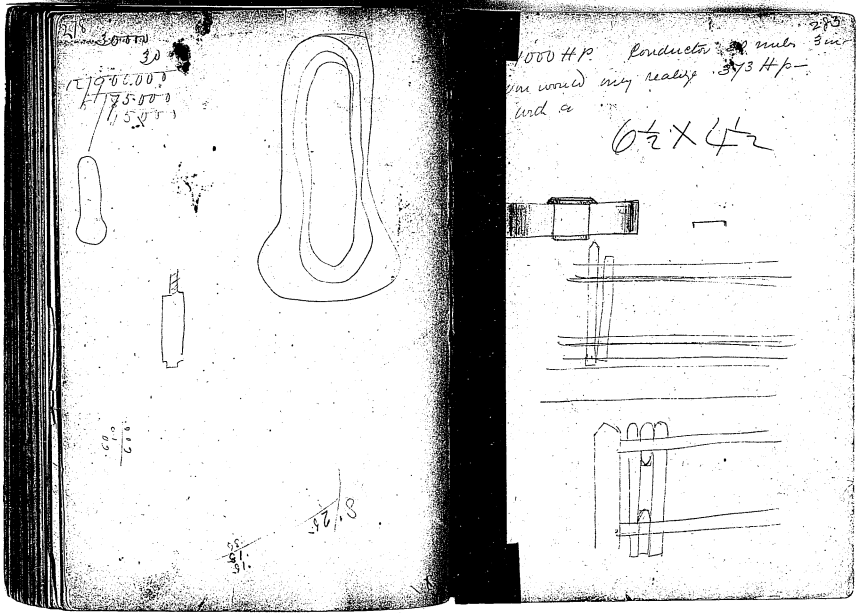








Practical treatise on Sea Sickness
G. M Beard published by
E. B. Treat.

J M Bennett 141 st St
Self Contradiction of the Bible
Ladies Cooperative Dress Ass.
112 5th Ave N.Y. Circular

Bridges where are they going
with telephone — have they
got any circular system
yet — when will?